UNITED STATES PATENT APPLICATION

OF

Cheryl Hite
Tyler Morse
Ofer Matan
Tiffany Boehmer
Illah Nourbakhsh
Serdar Uckun
Jason Fama
Edward Reusser
Gregory Fichtenholz
Simon Shvarts

FOR

METHOD AND SYSTEM FOR CONCURRENT ERROR IDENTIFICATION IN RESOURCE SCHEDULING

Prepared by:
Wilson Sonsini Goodrich & Rosati
650 Page Mill Road
Palo Alto, California 94304-1050

Attorney Docket No.: 20191-703

Express Mail Number : __EL757542538US__

METHOD AND SYSTEM FOR CONCURRENT ERROR

IDENTIFICATION IN RESOURCE SCHEDULING

FIELD OF THE INVENTION

5   The invention is in the field of real-time error handling. More particularly

this invention relates to the real-time handling of resource scheduling conflicts and

resolution of those conflicts in a complex scheduling environment.

BACKGROUND OF THE INVENTION

10   Resource scheduling is a complex task that requires satisfaction of several

potentially conflicting goals and constraints. In a complex environment a resource

scheduling algorithm may reach its conclusion with several unfulfilled goals and

exceptions. These unfulfilled goals frustrate the intended result of a working

resource schedule. One such complex environment of resource scheduling is call

15   center forecasting and agent scheduling. In this complex and diverse setting, a

significant amount of configuration and parameter specifications must be done via

user interfaces before a final result can be produced. Existing applications for

resource scheduling do not adequately produce an unobtrusive interactive

mechanism for warning the user of parameter or configuration selections that are

20   likely to result in poor performance or failure of the schedule.

Current algorithms produce warnings or an indication of a conflict that

interrupt the scheduling process. Present systems, known to one skilled in the art,

use modal interfaces to detect and inform the user of errors. Errors that are detected in mid-stream of the user's work forcibly interrupt the user with a warning message. This warning message prevents the user from continuing work without at least acknowledging its presence. These warning mechanisms are rigid in their

5 application and, if disabled, are completely ineffective at providing any type of failure notification. This warning process is accomplished through a series of programmed communications between the error detection program and the primary scheduling program that results in the scheduling operations to cease.

The prior art fails to provide an unobtrusive or concurrent means to notify a

10 user of a resource scheduling conflict. By forcing the user to interact with a warning or notification of a pending error, the efficiency of the scheduling process suffers. If the user elects to dismiss the warning, no further indication is present to convey to the user that the conflict is still present. Furthermore, should a user elect to correct the conflict upon receiving notification, the user is required to navigate

15 independently in the program to the position in the program that contains the root cause to the conflict, again decreasing efficiency and rising the cost of the scheduling method.

SUMMARY OF THE DISCLOSURE

20 A method and system for handling real-time identification and notification of resource scheduling conflicts is described. In one embodiment, the claimed method works concurrently with a resource scheduling process to indicate to the

user in an unobtrusive manner that a resource conflict has occurred. The user, upon selecting the indication of an error, is provided with a description of the conflict and the option of suppressing or resolving the resource conflict. In another embodiment the indication is represented by a visual depiction of a stoplight

5   located at the lower right corner of the display. The colors red and yellow are used to depict unsuppressed and suppressed conflicts respectively. One skilled in the art will recognize that the identification and notification of the conflict may be through any number of media including but not limited to visual, aural, or tactile means.

       If the user elects to resolve the resource conflict, one embodiment provides

10   a hyperlink utilizing ordinary Hypertext Markup Language ("HTML") to link the user to the corresponding portion of the scheduling process where the conflict exists. Furthermore, should the user elect to use the hyperlink to access the appropriate page, the entry that is creating the conflict is highlighted for ease of identification. Once the conflict has been resolved, the real-time indication, in this

15   embodiment the stoplight, will revert to a green light indicating that no resource conflicts exists. Conversely if the user elects to suppress the conflict the red light will change to yellow and remain illuminated until the suppressed conflict is resolved. Should a new conflict arise, both the red light and the yellow light will illuminate indicating that suppressed as well as unsuppressed resource conflicts

20   exist. Throughout these indications of conflicts the functionality of the scheduling process remains unaffected and the user is unimpeded should he or she decide to ignore the conflict indication.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a block diagram of an embodiment of a network system for real-time resource scheduling error identification.

5

Figure 2 is a depiction of an embodiment for real-time resource scheduling error identification showing a conflict situation.

Figure 3 is a depiction of an embodiment for real-time resource scheduling error identification showing a situation with no resource conflicts.

Figure 4 is a depiction of an embodiment for real-time resource scheduling

10 error identification showing a conflict description and resolution window.

Figure 5 is a depiction of an embodiment for real-time resource scheduling error identification associated with specific resources.

Figure 6 is a depiction of an embodiment for real-time resource scheduling error identification illustrating a typical list of rule based conflicts associated with a

15 specific resource.

Figure 7 is a depiction of an embodiment for real-time resource scheduling error identification showing a calendar based conflict associated with a specific resource.

Figure 8 is a depiction of an embodiment for real-time resource scheduling

20 error identification showing a resolution window associated with a calendar conflict of a specific resource.

Figure 9 is a high level flow diagram for an embodiment of a method for real-time resource scheduling error identification.

DETAILED DESCRIPTION

5   A system and method for real-time handling of error identification and notification in complex environments, such as call centers, are described. In the description that follows, numerous specific details are set forth in order to provide a thorough understanding of the present invention. It will be evident, however, to one skilled in the art that the method and system presented may be practiced

10   without these specific details.

Figure 1 is an embodiment of a system, 100, for providing a real-time identification and notification of resource scheduling conflicts. The system includes multiple client computers, 102-105, which are coupled to the server, 106, through a network, 108. The network, 108, can be any network, such as a local

15   area network, a wide area network, or the Internet. The client computers each include one or more processors and one or more storage devices. Each of the client computers also includes a display device, and one or more input devices. All of the storage devices store various data and software programs. In one embodiment, the method for providing a real-time indication of resource conflicts in a resource

20   scheduling process is carried out on the system, 100, by software instructions executing on one or more of the client computers, 102-105. The software instructions may be stored on the server, 106, or on any one of the client

computers. For example, one embodiment presents a hosted application used by a call center of an enterprise that requires complex scheduling of many employees. The software instructions are stored on the server and accessed through the network by a client computer operator of the enterprise. In other embodiments, the software

5   instructions may be stored and executed on the client computer. A user of the client computer with the help of a user interface can enter data required for the execution of the software instructions. Data required for the execution of the software instructions can also be accessed via the network and can be stored anywhere on the network.

10   One embodiment of a method for providing a real-time identification of resource conflicts during a scheduling process can be used in the call center environment. A call center is an organization that answers and responds to telephone calls from customers for one or more particular organizations. Call centers also respond to other customer contacts, such as e-mail, faxes, voice over

15   Internet protocol, and web chat. Such centers possess a plurality of resources. A resource can be the equipment, the employees, the facilities, or any other asset that facilitates the business in achieving its purpose. In a call center the individual employees answering the calls are agents and each possesses a particular skill set. Each employee is therefore an example of a resource with specialized skills. For

20   example one agent may be able to respond to technical problems, another may specialize in billing questions and still another may specialize in taking product orders. Each agent likely possesses multiple skill sets and a call center manager's

challenge is to optimize the agents' schedules so as to maximize the utilization of these skill sets without compromising the functionality of the center, thus minimizing cost.

As the call center schedule is developed, minor modifications in an employee's availability schedule or the call center's resource requirements can require the entire schedule to be regenerated. Numerous working parameters and employee criteria are established to ensure the profitability and efficiency of day to day operations. Considerations such as the maximum number of hours worked per pay period per employee, the maximum period of work without a break, or the necessity for at least two experienced call agents to be on call at any one time are examples of such criteria and parameters. In one embodiment of the present method, as a scheduler inputs changes into a working schedule, a real-time indication is presented to the user if the alteration in the schedule affects a parameter or criteria adversely and will impair the overall functionality of the schedule.

Real-time indications are a result of the scheduling program constantly recalculating the viability of the proposed data into a working schedule. As new data is input the entire schedule is reconfigured and checked for conflicts without any interface or input by the user other than the original entry of the data. The feedback to the user of any conflicts is immediate. For example, an alteration of an agent's ability to maintain a work shift may have dramatic overall affects. Since the agent possesses a certain skill set and the call center must be maintained with a

minimum level of skilled individuals, the deletion of the agent's skills from the

working schedule may result in the center being understaffed for a particular

period. In such a situation the real-time error identification system would present,

in one embodiment, a red light depicted as, but not limited to, a stoplight at the

5   bottom of the display to notify the user of the conflict.

The indication would occur as soon as the user altered the employee's

schedule. Since the indication of the error is unobtrusive, meaning that the display

of the conflict or scheduling problem would not interfere with the normal operation

of the scheduling program, the user can continue to alter the schedule as he or she

10   feels fit. Thus, if in this example the user was aware that the alteration of the

agent's work schedule would present a problem but has already envisioned a

resolution of the conflict, the user need not waste time by having to interact with

warning system needlessly. Upon seeing the indication of a conflict, the user could

input the potential solution and see if the red light is removed indicating the

15   conflict has been resolved thus validating the envisioned solution.

Likewise, in another embodiment, a user can first become aware of a

conflict through the real-time identification system. In this situation if a user alters

the schedule, the concurrent identification will unobtrusively notify him or her that

a problem exists. The system described in this embodiment does not require the

20   entire form or schedule to be completed before an error is detected. The user in this

embodiment can select the identification symbol, the red light in this case, and be

presented with a new window containing a description of the conflict as well as a

proposed solution. The user can then elect to suppress or ignore the conflict resulting in the illumination of a yellow light in the stoplight depiction or select a hyperlink located within the description that will open the primary scheduling process window centered on the functional area containing the conflict. The

5   window containing the conflict will further have the entry causing the problem highlighted for easy recognition. With the conflict resolved, the new window can be closed and the original scheduling process continued without the presence of an error indication.

If the user elects to suppress the conflict, the yellow light indication will

10   remain illuminated until the conflict is resolved. The suppression of the conflict does not impede the real-time identification of other conflicts. If an additional conflict is identified, a new red light indication is displayed in conjunction with the yellow light indicating a new conflict as well the multiple warnings or conflicts that are suppressed. Selection of the conflict identification will, in this embodiment,

15   present not only descriptions and potential solutions of the current conflict but of the suppressed conflicts as well. Further, if multiple conflicts exist that are not suppressed, selecting the red light will list all of the conflicts for the user's review. The resolution of the resource conflict removes the scheduling error and cancels any indication present. This can be accomplished by following advice given in the

20   resolution window or by disregarding the potential solution and inputting a different change that will alleviate the conflict.

An additional embodiment provides the user with a means to associate a conflict with a particular resource and provides a real-time indication of that association to the user. As with the previous embodiments, the identification and handling of resource conflicts occurs concurrently with the primary scheduling

5   process. Once a conflict occurs, an indication of the conflict is presented to the user in such a manner as to not interfere with his or her use of the application. In addition to the real-time communication of a problem, this embodiment provides a method wherein the specific resource associated with or causing the conflict is readily identified to the user.

10   In one embodiment, a visual indication or symbol is placed next to the resource that is associated with a conflict. Furthermore, this method of identification can differentiate the type of conflicts associated with each resource. If, for example, the conflict is rule based such as exceeding the maximum number of hours worked per week, this embodiment conveys this information to user

15   without interrupting the scheduling process by placing a symbol next to the resource. Likewise if a conflict is due to a scheduled meeting or similar calendar event, the method can similarly communicate such information to the user without disrupting the normal operation of the scheduling process. In one embodiment the method places a visual indication such as an exclamation mark or any other form of

20   visual symbol next to the conflicted resource and alters the color of the exclamation mark based on the type of conflict. Likewise the indication could be aural or any other similar medium to communicate the identification of a conflict to the user. If,

in this embodiment, the exclamation mark is blue the conflict associated with that

employee rises from a rule problem whereas if the exclamation mark is red the

problem is based in a conflict with a meeting or other calendar events. These and

other depictions are described in the following diagrams.

5   **Figure 2** is a depiction of a Recorded Call Volumes page, 220, of an

embodiment for real-time identification and notification of resource conflicts. In

this embodiment the depiction of a stoplight, 210, presents an indication of a

resource conflict to the user. Here, the stoplight can be found in the lower

rightmost corner of the window with the left, 230, red light illuminated indicating

10   that a conflict exists. The stoplight, or any other suitable depiction to convey the

existence of a resource conflict, can be located at a plurality of locations on the

window. The stoplight in this embodiment is configured as a single row of lights in

a horizontal orientation near the navigation and home icons located in lower right

hand corner of the window. The stoplight depicts a conventional configuration of a

15   traffic signal with a red light being the furthermost left light, the green light being

furthermost to the right, and a yellow light in the center. **Figure 3** is depiction of

an Operations Parameters page, 320, of an embodiment for identification and

notification of resource conflicts where no conflicts exist. This window possesses a

similar stoplight, 310, as described above which is also located in the lower right

20   corner. In this embodiment the stoplight has the far right, 330, green light

illuminated indicating to the user that no resource conflicts are present. In either of

these embodiments using a stoplight pictogram for indicating a resource conflict,

the center light, if illuminated, would be yellow and would indicate that a conflict or multiple conflicts have been suppressed by the user.

Figure 4 depicts the resolution window of one embodiment of a method for real-time identification of resource scheduling conflicts. This window appears after an indication of a conflict has been presented to the user, such as a red light illustrated above, and the user has clicked on the light to view the potential solution in an effort to resolve the conflict. The window in Figure 4 indicates that there are multiple conflicts to be resolved, 410 and 420. The error identification program identifies and informs the user of the location of the potential problem on the top line, 430. In this embodiment the conflict has been found in a shift named "New Shift," 440. The method has determined that New Shift does not have a start time and is in violation of a program rule. The window offers a solution to the conflict by stating that New Shift must have at least one valid start time. Furthermore, this embodiment presents a hyperlink, 450, to the location in the scheduling program where correct start times should be input. If the user selects the hyperlink "here," 450, the program will open a window where the user can define a start time thus resolving the conflict. The new window will highlight the area that must be altered to resolve the conflict. Also depicted in Figure 4 are two suppress buttons, 460, associated with the two displayed conflicts. These buttons allow the user to suppress the current conflicts and illuminate the yellow light in the stoplight pictogram.

Figure 5 is a Calendar page, 520 using one embodiment of a method for identification and notification of resource conflicts where conflicts are associated with specific resources. The depiction shows a schedule calendar for the date Monday, January 29, 2001. Under the date, 530, is a plurality of columns including one categorizing the resource being scheduled as employee. In the embodiment illustrated in **Figure 5** there are ten resources all of the category employee, 510. To the right of the category listing is another column that individually identifies each resource. This column contains an employee identification number illustrated in this embodiment by empl#1 through empl#10, 550. In this embodiment, for the resources identified as empl#1, 560, empl#2, 570, and empl#4, 580, an exclamation mark, 590, located in the column immediately adjacent to the employee's identification number. This exclamation mark indicates that there is a resource conflict associated with each of these employees.

An additional embodiment further allows the user to review all the conflicts associated with a particular resource and individually select which conflicts are to be resolved. **Figure 6** is a Conflicts page, 620, of an embodiment of the method for identification and notification of resources conflicts where an employee has been associated with a conflict and the user has selected to review the conflicts. After the user clicks on the associated symbol, a list of conflicts associated with that resource is displayed, 630. In **Figure 6** empl#1 has three rule based conflicts, 630, associated with empl#1's involvement with the schedule. **Figure 7** presents another embodiment of a Conflict page, 620, showing a calendar conflict, 730,

associated with empl #2. As depicted in **Figure 7**, the calendar conflict is

resolvable by selecting the button on the bottom of the page, 740. By selecting the

resolution option, 740, one embodiment opens a new window on top of the conflict

window to offer possible solutions as well as presenting links to the area of the

5   program where alterations to the resource's utilization must be changed. **Figure 8**

depicts a Resolve Calendar Conflict page, 820, giving the user an interactive means

to correct the conflict. The conflict is repeated to the user, 830, and then, in this

embodiment, two resolution choices are presented to the user, 840 and 850. In one

embodiment the user is presented with a solution that marks empl#2 as not

10   attending the meeting thus removing the calendar conflict, 840. Secondly, the user

may ignore the conflict until a new schedule is created, 850. Having made a

choice, the user than can apply the selection, cancel the resolution process, or seek

additional help by using the three user interactive buttons located at the bottom of

the page, 860.

15   **Figure 9** is a high-level flow diagram of one embodiment of a method for

concurrent real-time identification of resource scheduling conflicts. The

identification process begins at 202 when a user activates a scheduling window or

enters new data into the resources scheduling window. In one embodiment, an

error identification method is located within the primary resource scheduling

20   process and acts concurrently with the primary scheduling process to analyze the

new data for any conflicts or problems. While error identification and notification

of resource conflicts can operate independently of the primary resource scheduling

process, it is shown here, 204, as an integral part of the overall scheduling system. If the analysis determines that the new data does not present any conflicts or problems a green light is displayed, 208.

If a conflict is recognized, one embodiment queries the analysis program to determine if the conflict is associated with a specific resource such as an employee, 209. If the conflict is resource specific the method further determines if the conflict is rule or calendar based, 210. If the conflict is rule based, the method directs the scheduling process to display a blue exclamation point next to the resource causing the conflict, 211. If the conflict is calendar based a red exclamation mark, in one embodiment, is displayed next to the resource causing the conflict, 213.

Should the examination identify a problem in the schedule, 206, and the problem is not associated with a specific resource or the resource that is identified is already marked, the method questions if the conflict has been suppressed, 214. A negative answer displays a red light, 214, confirming the existence of an unsuppressed scheduling conflict. Should the answer to the suppression question be affirmative, a query occurs as to the existence of any other unsuppressed conflicts, 215. If the answer is yes then, as indicated in 218, both a red light and a yellow light are illuminated indicating the presence of both an unsuppressed and a suppressed conflict. If only suppressed conflicts are present, then only a yellow light is illuminated, 216. At this point the user must elect to click on the displayed lights indicated in blocks 217, 216, or 218 for further information. If the user clicks on the red light, 220, a new window containing an HTML page is generated,

222, describing the conflict and suggesting potential solutions, 232. To do this, one

embodiment utilizes a warning template file, 224, and the Windows Registry, 226.

Likewise if the user clicks on the yellow indication light, 228, an HTML

page is generated, 230, describing the suppressed conflict or conflicts and potential

5   solutions, 232. Contained within the new HTML page is a hyperlink that connects

the user to the specific window within the primary scheduling resource software

where the conflicted resource must be altered. If the user clicks on the hyperlink,

234, one embodiment communicates with the primary resource scheduling

software, 236, causing the display of the specific window, 240, necessary to modify

10   the erroneous data. Additionally, the data that must be altered is highlighted to

facilitate the user in resolving the conflict. If the user elects to suppress the

conflict, 242, the conflict is marked appropriately, 244, and is stored in the

Windows Registry, 248. If the user elects to un-suppress the conflict, 244, an

HTML page is generated, 246 based on the new unsuppressed conflict.

15   From the above description and drawings, it will be understood by those of

ordinary skill in the art that the particular embodiments shown and described are

for purposes of illustration only and are not intended to limit the scope of the

invention. Those of ordinary skill in the art will recognize that the invention may

be embodied in other specific forms without departing from its spirit or essential

20   characteristics. References to details of particular embodiments are not intended to

limit the scope of the claims.